X-37 Space Maneuver Vehicle passes development test at Neutral Buoyancy Laboratory

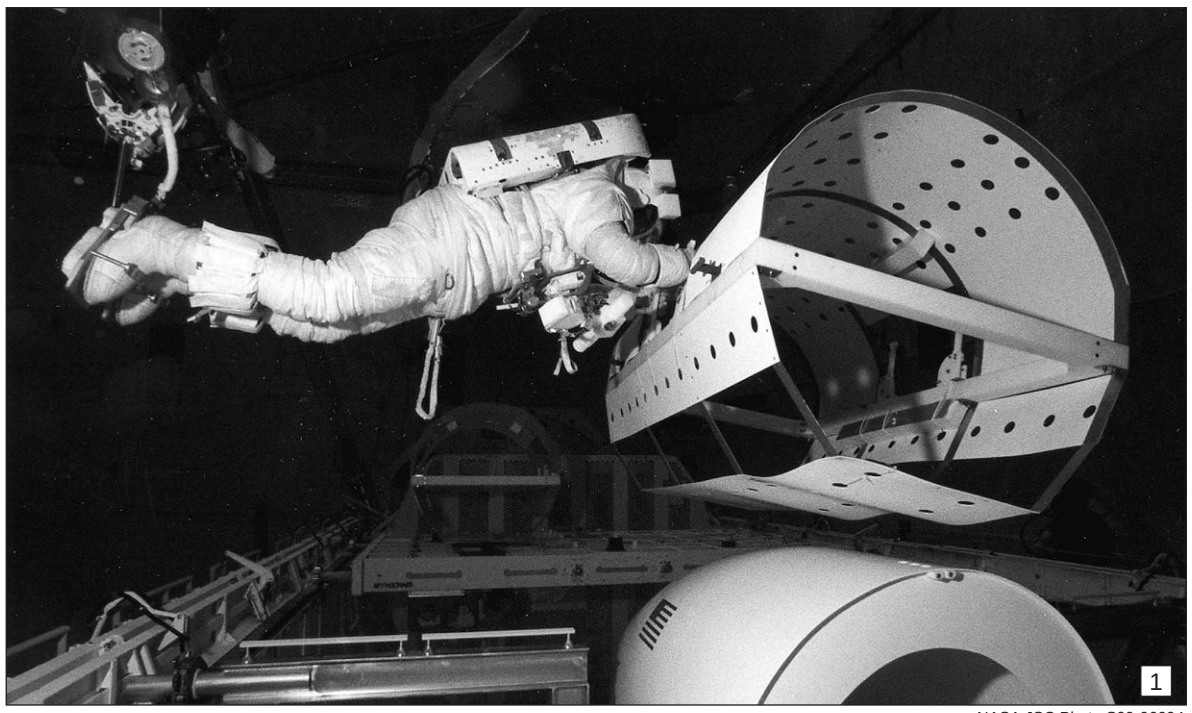
History was made when a development test for the X-37 Space Maneuver Vehicle was conducted in the Neutral Buoyancy Lab at the Sonny Carter Training Facility. The test was designed to evaluate the X-37's conceptual Extravehicular Activities interfaces to ensure that the design of the vehicle provides for the necessary on-orbit serviceability.

The vehicle tested in the NBL actually represents two programs with very similar vehicles. The X-37 is a Marshall Space Flight Center project to demonstrate new technology during one or two space shuttle missions. The Air Force SMV is intended to be an unmanned, operational vehicle to carry payloads to orbit and remain there for up to one year. The SMV will have enough fuel capacity to fly around the moon if desired before returning for a runway landing on Earth. The Air Force has completed auto-land testing of an aerodynamic mockup by dropping it from a helicopter. The next phase involves dropping the flight vehicle from a B-52 aircraft before sending it to the Kennedy Space Center for its first shuttle flight. Both vehicles are scheduled to fly aboard the space shuttle in about three years.

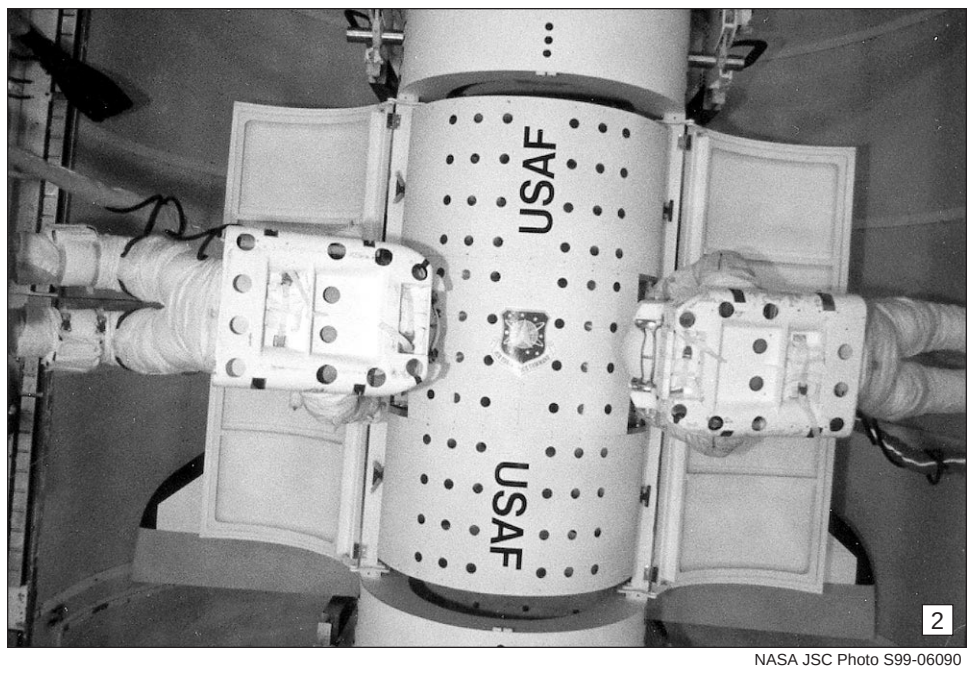
> *Evaluating the EVA aspects of the X-37 early in the design cycle will help to ensure that the vehicle will be easily serviced by space-walking crewmembers.*
>
> – Greg Harbaugh

"Evaluating the EVA aspects of the X-37 early in the design cycle will help to ensure that the vehicle will be easily serviced by space-walking crewmembers," said Greg Harbaugh, manager, JSC EVA Project Office. "This will result in a significantly improved development track in that late cycle design changes will not be needed to address EVA issues."

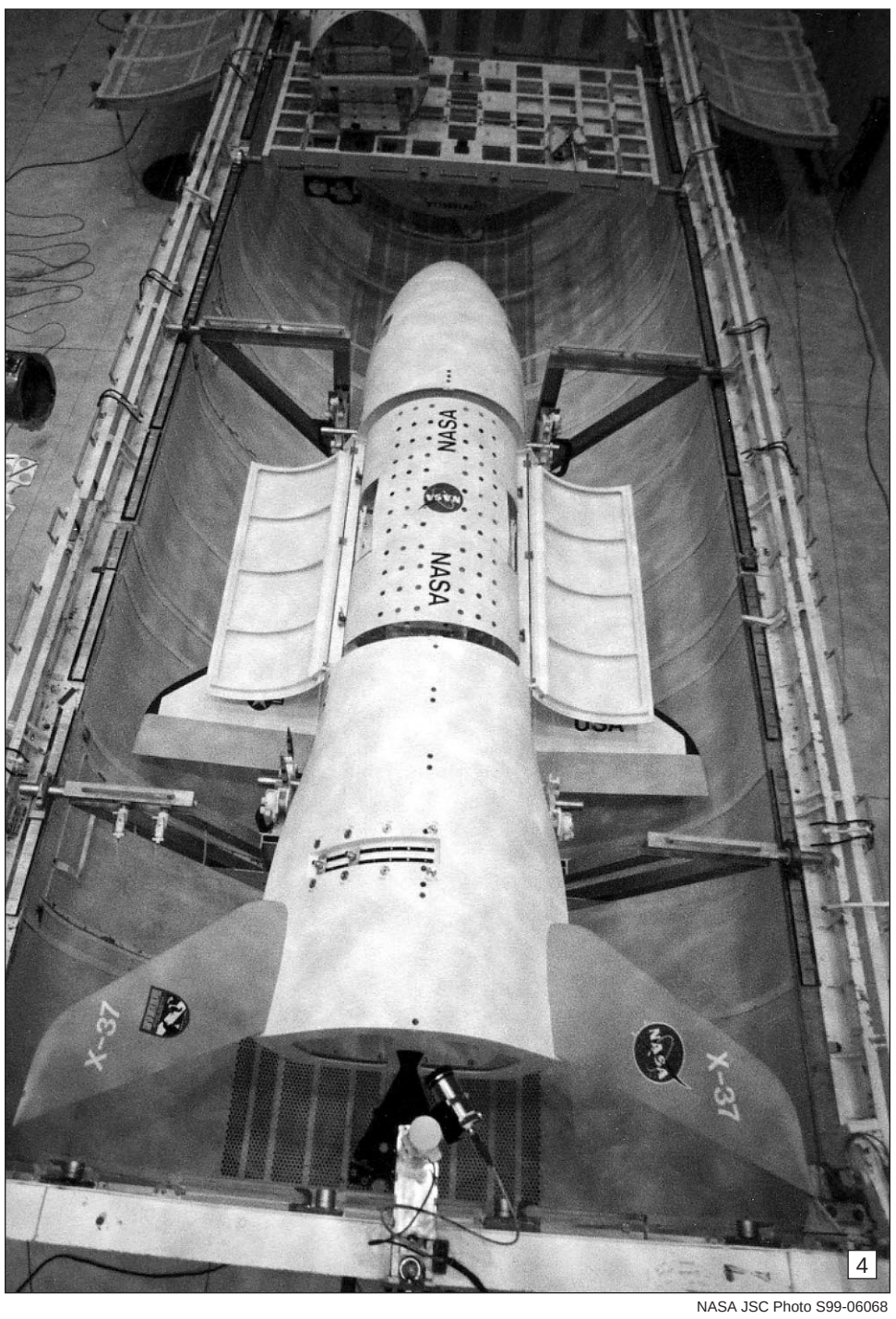
The primary objectives of the test were to evaluate planned and contingency EVAs for refueling and payload changeout for the X-37. Planned EVAs included the use of the Shuttle Remote Maneuvering System to access the refueling ports on the X-37 and maneuver payloads from the X-37 cargo bay to the SpaceHab Integrated Cargo Carrier Pallet. Contingency operations assumed that the SRMS was not available and that two crewmembers had to perform the refueling and payload swap from Portable Foot Restraints. These capabilities are important to meet Air Force objectives to fly multiple missions during the same space shuttle flight.



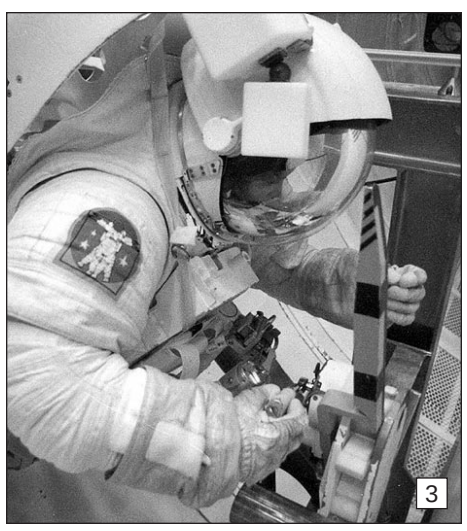
NASA JSC Photo S99-06094



NASA JSC Photo S99-06090



NASA JSC Photo S99-06068



NASA JSC Photo S99-06083

1 A crewmember checks out payload maneuvering with the Shuttle Remote Maneuvering System.

2 Crewmembers go through the payload installation sequence.

3 A crewmember checks out access to the Payload Retention Latch Assemblies for contingency manual release.

4 This photo shows the configuration of the test articles. Each test article was configured to simulate the anticipated flight configuration as much as possible given the existing mockup limitations.

A secondary objective evaluated during the test was access for the contingency release of the Payload Retention Latch Assemblies and locations for Cradle EVA interfaces. This objective verified that the EVA crew could access and manually open the motor-driven latches that hold the X-37 SMV into the orbiter during launch. The Cradle is the structure between the orbiter and the X-37 SMV. The design of the Cradle was not evaluated during the test except to demonstrate access to latches.

The test was successfully completed with all of the planned objectives evaluated. The test provided a wealth of information on X-37 EVA operations. Boeing designers in Seal Beach, Calif., will use this data to design both the X-37 and the Air Force SMV.

An X-37 NBL mockup constructed almost entirely from fiberglass was used for the test. The aluminum Cradle was a conceptual representation of the hardware needed to secure the X-37 in the shuttle payload bay. Two plastic payload mockups representing the maximum volumetric payload capacity of the X-37 were also used. Each test article was configured to simulate the anticipated flight configuration as closely as possible given existing mockup limitations.

EVA servicing tasks for the X-37 were conducted during the 3-day investigation, with each test run scheduled as a 4-hour space walk. All subjects evaluated all of the tasks during each run. Each subject evaluated the X-37 refueling and payload changeout operations both with and without the SRMS. In addition, access to the PRLAs was evaluated for the contingency release of the X-37 from the orbiter.

Test subjects were Arne Aamodt from the Mission Operations Directorate and astronauts Carl Walz, Dave Wolf, Michael Anderson, Michael Fincke, Mark Lee and Susan Helms.

"This kind of early involvement with payload development allows the whole NBL test team to provide the most value," Wolf said. "It reduces future design changes and enhances the final product. It is exactly what we like to see."

The evaluation was coordinated and conducted by the Lockheed Martin Space Operations Test Implementation and Core Test Support Group, part of the Crew and Thermal Systems Division at JSC. Other JSC organizations participating were the Mission Operations Directorate and the Flight Crew Operations Directorate. Both support the EVA Project Office and EVA Analysis and Integration Team in overseeing the test and evaluation of EVA hardware. Contractor personnel from Schafer Corp. and Muniz Engineering also helped with the test. ■